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ARTICLE

A checklist of the bees (Hymenoptera: Apoidea) of Manitoba, Canada

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Abstract

We record 392 species or morphospecies of bees (Hymenoptera: Apoidea) for Manitoba, Canada, which is 154 more species than reported in 2015 and includes five new generic records since 2015 (*Ashmeadiella*, *Brachymelecta*, *Eucera, Neolarra,* and *Triepeolus*). Thirteen new records reported here are new for Canada: *Calliopsis* (*Nomadopsis*) *australior* Cockerell, *Perdita* (*Perdita*) *tridentata* Stevens, *Brachymelecta interrupta* (Cresson), *Diadasia* (*Dasiapis*) *ochracea* (Cockerell), *Melissodes bidentis* Cockerell, *Nomada crawfordi crawfordi* Cockerell, *Nomada fuscicincta* Swenk, *Nomada sphaerogaster* Cockerell, *Nomada xantholepis* Cockerell, *Triepeolus* cf. *grindeliae* Cockerell, *Dianthidium* (*Dianthidium*) *parvum* (Cresson), *Coelioxys* (*Xerocoelioxys*) *nodis* Baker, and *Megachile* (*Megachiloides*) *dakotensis* Mitchell. We remove the following species from the list of Manitoba bees based on re-examination of voucher material: *Andrena* (*Ptilandrena*) *geranii* Robertson, *Andrena* (*Rhacandrena*) *robertsonii* Dalla Torre, *Andrena* (*Simandrena*) *nasonii* Robertson, *Andrena* (*Trachandrena*) *ceanothi* Viereck, *Andrena* (*Trachandrena*) *quintilis* Robertson, *Lasioglossum* (*Hemihalictus*) *pectoraloides* (Cockerell), *Lasioglossum* (*Lasioglossum*) *forbesii* (Robertson), and *Dianthidium* (*Dianthidium*) *concinnum* (Cresson). We propose that *Nomada alpha paralpha* Cockerell, 1921 and *N. alpha dialpha* Cockerell, 1921 are junior synonyms of *N. alpha* Cockerell, 1905. *Nomada arenicola* Swenk, 1912 is considered a junior synonym of *N. fervida* Smith, 1854. *Protandrena albertensis* (Cockerell) and *Neolarra mallochi* Michener are recognised as valid species. We provide additional notes on taxonomy, nomenclature, and behaviour for select species in the list.

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Introduction

Bees (Hymenoptera: Apoidea: Anthophila) are a monophyletic group within the hymenopteran superfamily Apoidea (Melo 1999; Danforth *et al.* 2006; Debevec *et al.* 2012; Hedtke *et al.* 2013; Branstetter *et al.* 2017). Seven families of bees are currently recognised (Michener 2007), with six occurring in Canada: Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae, and Melittidae. Some authors prefer to recognise a single bee family (Moure *et al.* 2007), but this practice is not widely accepted. Globally, more than 20 500 bee species have been described (Ascher and Pickering 2022), and more than 900 bee species have been documented in Canada (Sheffield *et al.* 2017; Sheffield 2019). Bees in Canada are divided into 52 genera, although generic limits differ among authors (Mitchell 1960, 1962; Michener 2007; Dorchin *et al.* 2018; Ascher and Pickering 2022). Bees display a range of anatomical and behavioural adaptations that contribute to their biodiversity and aesthetic quality.

Most bees are solitary and live in underground burrows or pre-existing cavities (Krombein 1967; Cane *et al.* 2007; Michener 2007; Cane and Neff 2011; Danforth *et al.* 2019). Less commonly, nests are excavated in wood and constructed externally on substrates or under rocks. Honey bees (*Apis mellifera* Linnaeus) and bumble bees (genus *Bombus*) are unusual for making wax structures in larger hollows in trees or, often the case among bumble bees, abandoned rodent burrows (Michener 1974; Plowright and Laverty 1984). Social behaviour in *Apis* and *Bombus* is well known, but it also commonly occurs in the Halictidae. Social behaviour in halictids is much more plastic and variable than in *Apis* or *Bombus* (Michener 1974; Packer *et al.* 1989; Eickwort *et al.* 1996; Field 1996; Mueller 1996; Richards *et al.* 2003; Gibbs *et al.* 2012b).

Bees are known for their close connection with flowers, which extends back to the early Cretaceous, approximately 123 Ma (Cardinal and Danforth 2013). Bees typically harvest pollen and nectar from flowers to provision their nests (Portman *et al.* 2019). Flowering plants can exploit this behaviour for pollination. Some bees are specialist floral visitors (oligoleges), using only a small subset of available plants (Robertson 1926; Wcislo and Cane 1996; Cane and Sipes 2006). Polylectic bees use a wide range of flowers, a trait that may have aided the early diversification of bees (Murray *et al.* 2018). Many bees – approximately 13% – do not collect pollen but act as brood parasites in other bee nests (Michener 2007; Danforth *et al.* 2019). This strategy has originated multiple times in bees (Smith *et al.* 2007; Cardinal *et al.* 2010; Gibbs *et al.* 2012a; Litman *et al.* 2013). In general, bees are considered among the most important animal pollinators (Kevan and Baker 1983; Ollerton *et al.* 2011).

Over the last two decades, there has been substantial interest in the status of pollinators (Allen-Wardell *et al.* 1998; Kevan and Phillips 2001; Marlin and LaBerge 2001; Biesmeijer *et al.* 2006; Berenbaum *et al.* 2007; Potts *et al.* 2010; Winfree 2010; Colla *et al.* 2012; Bartomeus *et al.* 2013; Lebuhn *et al.* 2013; Senapathi *et al.* 2015). With the possible exception of bumble bees (Cameron *et al.* 2011; Kerr *et al.* 2015), few wild bee taxa have been sufficiently well documented in North America to provide effective baseline data to reliably measure conservation status. Museum data can provide some insight into historical trends, but analysing these data can be challenging due to the inconsistent and usually unknown sampling methods applied over time (Bartomeus *et al.* 2013, 2019). Statistical modelling can provide predictions of how land-use changes may affect bees (Koh *et al.* 2016), but these are a poor replacement for empirical studies of actual bees. Several published and unpublished checklists have become available for states and provinces in recent years for North America (Donovall and VanEngelsdorp 2010; Jean 2010; Scott *et al.* 2011; Canadian Endangered Species Conservation Council 2015; Dibble *et al.* 2017; Gibbs *et al.* 2017; Kilpatrick *et al.* 2020). A consistent trend that emerges in these studies is how limited basic inventories or checklists of bees are for most of the continent (Jamieson *et al.* 2019). Without these baseline data, efforts to monitor trends in bees are quixotic (Tepedino *et al.* 2015).

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Historical bee collection in Manitoba, Canada

Entomological research in Manitoba, Canada was strongly influenced by Norman Criddle (1875–1933). Criddle and his siblings were avid collectors and natural historians (Criddle 1975). The homestead near Treesbank on which he was raised, referred to on collection labels as Aweme, and now the Criddle/Vane Homestead Provincial Park, is an important historical site for entomology (Roughley 2000). Aweme as a locality may be a much broader area than just the Criddle homestead, based on the breadth of species, including habitat specialists, labelled with this location. In 1913, Criddle was employed by the Division of Entomology of the Canadian Dominion government's Experimental Farms Branch (then a division of the Dominion of Canada's Department of Agriculture; now under Agriculture and Agri-Food Canada) as an entomological field officer for Manitoba and, beginning in 1919, as an entomologist (Gibson and Crawford 1933). Criddle began the first federal entomology lab at Aweme in 1915, which was the centre for early entomological research in the province. The Criddle home, known as St. Albans, was a meeting spot for Criddle's friends and colleagues. Although Criddle's professional work was focused on crop protection, particularly against grasshoppers, many of our earliest records of bees and many other insects for Manitoba stem from his collections (Gibson 1914, 1915, 1916, 1917; Gibson and Criddle 1920), including specimens used in the description of new bees (Sladen 1916a).

Ralph Durham Bird (1901–1972), a native Manitoban, worked at Aweme under the direction of Criddle from 1924 to 1926. He left Manitoba for several years but returned in 1933 to head the Federal Entomology Laboratory following Criddle's death (Bird 1975). The laboratory at that time moved to Brandon, Manitoba. He came to reside in Winnipeg, Manitoba with the founding of the Dominion's Department of Agriculture Research Station to head the entomology section and later its crop protection section. Bird's research career, like Criddle's, focused primarily on agricultural pests, but he collected several early bee records for the province.

John Braithwaite Wallis (1876–1962) was a friend and colleague of R.D. Bird and the Criddle family. Wallis's interests were primarily in other insect orders: he wrote a monograph on tiger beetles (Wallis 1961). Wallis was hired by the Department of Entomology of the Manitoba Agricultural College to build an insect collection. In 1983, the collection was renamed the J.B. Wallis Museum of Entomology in his honour (Galloway *et al.* 2010). The department itself was founded in about 1920 by Alvin Valentine Mitchener (1888–1962), who was the first entomologist at the University of Manitoba (then the Manitoba Agriculture College), where he worked until 1954. Mitchener's work with bees was largely limited to honey bees, although his long-term data on pollen and nectar plants are of value to those interested in wild bees (Mitchener 1948).

Bee collections in the province were largely haphazard in the first half of the 20th century. One exception is a study of the province's bumble bees by Felix Neave (1901–1986), which recognised 23 species (Neave 1933). Alexander Jardine Hunter (1868–1940) was a medical doctor and missionary in Teulon, Manitoba (Mitchell 1940). His collections provide an early record of the Interlake fauna between Lake Manitoba and Lake Winnipeg. Interest in native pollinators began to emerge in the 1940s and 1950s out of the Field Crop Insect Laboratory in Brandon, based on specimen records and publications (Cole 1955; Stephen 1955). Several scientists at Brandon collected bees at least occasionally, including R.D. Bird (above), Walter Askew (1929–2000), and Clifford Francis Barrett (1925–2017). William Procuronoff Stephen (1927–2016) and Thomas Victory Cole (1918–1999), of the Brandon lab, both conducted research on alfalfa pollination (Cole 1955, 1957; Stephen 1955; Bird 1963). Stephen, although a native Manitoban, spent little of his professional career in the province, working at Brandon only from 1947 to 1952 before taking a position at Oregon State University, Corvallis, Oregon, United States of America (Bird 1963). Nevertheless, his taxonomic revision of *Colletes* had a lasting impact on North American melittology and included numerous records from the

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province (Stephen 1954). His subsequent introduction of blue vane traps for bee collecting (Stephen and Rao 2005) has also changed the way collectors survey bees globally. Beginning in 1953, Cole led research on insect pollination of alfalfa at the field station in Wanless, Manitoba, which resulted in long series of bees, especially *Bombus* and *Megachile*. Cole studied leafcutters and created artificial nests for *B. terricola* Kirby (Cole 1957; Bird 1963). He also developed methods, which were decades ahead of their time, for habitat management to improve pollinators in areas adjacent to field crops (Cole 1955). Pollinator research during this time also included a focus on sunflower crops, *Helianthus annuus* Linnaeus (Compositae) (Barrett 1955), which resulted in a series of *Protandrena* from Altona, Manitoba. In the 1950s, Arthur Robinson Brooks (1917–1962) and Leonard Alexander Kelton (born Konotopetz; 1923–2011) collected hundreds of bee records while surveying insects of the Prairie Provinces. Brooks had been a dipterist and Kelton focused on Hemiptera, but Brooks later undertook studies on numerous prairie insects (Riegert 1990; Henry and Gill 2016). Even though neither researcher was a hymenopterist, Brooks collected the only known specimens of *Holcopasites stevensi* Crawford from the province. In 1961, Herbert Edward Milliron (1923–1981) made a significant collection of bumble bees from the province, many of which are deposited at the Canadian National Collection, Ottawa, Ontario, Canada. He subsequently published a series on the bumble bees of the Western Hemisphere (Milliron 1971, 1973a, 1973b). Most bee research in Manitoba focused on two managed exotic species – the European honey bee and the alfalfa leafcutter bee (*Megachile rotundata* Fabricius). Honey bee research in the Department of Entomology, University of Manitoba, was led during this time by Stanley Cameron Jay (Holliday and Currie 2009). One of his students, Robert Christopher Plowright, completed his doctorate on *Bombus* domestication and caste differentiation (Plowright 1966; Plowright and Jay 1966, 1968). Applied studies of pollinators, although valuable, have not always provided much information on the broader bee fauna of the province.

General collections of bees in Manitoba were few during the 1960s, but in 1977, the Department of Entomology, University of Manitoba, hired Terry D. Galloway. Although Galloway's research was largely in veterinary entomology, he demonstrated a healthy interest in wild bees in the mid-1970s through the 1980s, based on more than 2000 specimen records. During the mid-1980s, William James Turnock (1929–2008) collected bees, although his research focus was on pest control. Turnock *et al.* (2006) published records of 15 bumble bee species captured inadvertently in baited traps for bertha armyworm, *Mamestra configurata* Walker (Noctuidae), in Manitoba canola fields. Also during this period, David Harvey Pengelly (1922–2004) was active in the province, primarily in the area of Erickson where he retired after a career as professor at the Ontario Agricultural College, University of Guelph (Guelph, Ontario, Canada; Marshall 2004). Pengelly's interest was primarily in the genus *Megachile*, which was the basis of his doctoral studies at Cornell University (Ithaca, New York, United States of America; Pengelly 1955). During his time, Pengelly inspired several young entomologists, including a future curator of the J.B. Wallis Museum of Entomology, Robert Edward Roughley (1950–2009). The museum expanded greatly during Roughley's tenure as curator. Roughley was an expert in aquatic beetles, but he also studied the fauna of grassland insects and conducted surveys at Aweme. He participated in a nationwide project to study Canadian pollinators, CANPOLIN (Galloway *et al.* 2010), which resulted in thousands of specimen records (Patenaude 2007). In 2011, the museum was rededicated as the J.B. Wallis/R.E. Roughley Museum of Entomology.

Bee collecting in Manitoba in the 2000s

A large survey of prairie bees was undertaken by one of Roughley's students, Andrea Patenaude. She collected extensively during her thesis work at Spruce Woods Provincial Park (Patenaude 2007). Patenaude's specimens were included in taxonomic studies of the genus

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Lasioglossum (Gibbs 2010). During CANPOLIN, bees were collected at Canadian Airforces Base Shilo neighbouring Spruce Woods Provincial Park. Several of these bees were sequenced as part of an effort to DNA barcode Canadian bees (Sheffield *et al.* 2017). More recent theses on wild bees in grasslands were conducted by Sarah Semmler and Reid Miller in the Tall Grass Prairie Preserve (Semmler 2015; Miller 2021), by Marika Olynyk in fragmented grasslands of southwestern Manitoba (Olynyk 2017; Olynyk *et al.* 2021), and by Emily Hanuschuk across multiple landscape in southern Manitoba (Hanuschuk 2021), resulting in more than 30 000 specimen records. These studies include novel records for the province, including the first provincial records of the genus *Dianthidium* (Semmler *et al.* 2018). Other surveys of wild bee diversity across multiple habitat types in southern Manitoba, including thesis research by Massimo Martini (2022), have contributed to the provincial records reported herein. In a survey of prairie bees in Canada, Sheffield *et al.* (2014) listed 218 species for the prairie region of Manitoba. A slightly larger list of 236 Manitoba bees was made available through a recent report on the status of species in Canada (Canadian Endangered Species Conservation Council 2015), and an online checklist of approximately 250 species was released by Sheffield (2019).

Relatively few of the studies on wild bees in Manitoba have resulted in peer-reviewed publications (but see Neave 1933; Turnock *et al.* 2006; Semmler *et al.* 2018; Robson *et al.* 2019; Gibbs *et al.* 2021; Olynyk *et al.* 2021). In 2017, research on wild bees at the University of Manitoba, Winnipeg, began in earnest, the results of which included the discovery of many new provincial records (Semmler *et al.* 2018; Gardner and Gibbs 2021; Onuferko *et al.* 2021; Satyshur *et al.* 2021; Wrigley *et al.* 2021). Among these were new national records and new species, as well as erroneous published records based on misidentified material. Hence, the purpose of the current study is to present these discoveries and provide a more accurate and complete checklist of the bees of Manitoba, which has changed considerably and is therefore warranted. This checklist is intended to stimulate renewed interest and support research on the Manitoba bee fauna and other areas of the Prairie Provinces and the north–central region of the United States of America. Due to the need for taxonomic revisions in several key bee groups (*e.g.*, *Nomada* and *Sphecodes*), this checklist is necessarily preliminary.

Methods

This study is restricted to the geographic boundaries of the Province of Manitoba, Canada. Manitoba is situated between the provinces of Saskatchewan to the west and of Ontario to the east, the territory of Nunavut to the north, and the states of North Dakota and Minnesota, United States of America, to the south. The Manitoban climate has extreme seasonality, with temperatures in the south ranging from –40 °C to 38 °C between winter and summer. There are six broad ecozones (Smith *et al.* 1998). The Taiga Shield, Southern Arctic, and the Hudson Plains occur in the north. The town of Churchill occurs near the northern limit of the Hudson Plains. The middle latitudes of the province to the southeastern corner are of the Boreal Shield Ecozone. The Boreal Plains Ecozone occurs to the southwest of the Boreal Shield. The southwestern part of the province is largely Prairies Ecozone, significant portions of which have been converted to large-scale agriculture.

An initial checklist was compiled using taxonomic literature (Mitchell 1935a, 1935b; Sandhouse 1939; Stephen 1954; Hurd and Michener 1955; Timberlake 1960; LaBerge 1961, 1967, 1971, 1973, 1977, 1980, 1986, 1987, 1989; Ordway 1966; Ribble 1967, 1968; Shinn 1967; Milliron 1971, 1973a, 1973b; LaBerge and Ribble 1972, 1975; Daly 1973; Donovan 1977; Bouseman and LaBerge 1979; McGinley 1986, 2003;

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Broemeling 1988; Rightmyer 2008; Gibbs 2010, 2011; Rightmyer *et al.* 2010; Sheffield *et al.* 2011; Gibbs *et al.* 2013, 2017; Williams *et al.* 2014; Onuferko 2017, 2018) and ecological studies (Cole 1955, 1957; Stephen 1955; Plowright 1966; Patenaude 2007; Olynyk 2017; Robson *et al.* 2019). Published records were confirmed, where possible, by examining material in relevant collections, particularly the J.B. Wallis/R.E. Roughley Museum of Entomology and the Canadian National Collection of Insects, Arachnids, and Nematodes (records digitised at https://www.cnc.agr.gc.ca/taxonomy/TaxonMain.php). The historical bee collections at the J.B. Wallis/R.E. Roughley Museum were re-examined and databased to be deposited on Canadensys (https://www.canadensys.net) and the University of Manitoba Dataverse (https://doi.org/10.34990/FK2/55PV3G). Material was examined from the Brandon Research and Development Centre, Agriculture and Agri-Food Canada, Brandon, the Canadian Museum of Nature, and the Illinois Natural History Survey, Prairie Research Institute, Champaign, Illinois, United States of America. Additional records come from other well-digitised collections, such as the American Museum of Natural History, New York, New York, United States of America. New collections were made as part of ongoing research projects and to fill gaps in our knowledge of Manitoban bees. These included records from student thesis projects (Emily Hanuschuk, Reid Miller, and Massimo Martini) and samples from the Manitoba Conservation Data Centre, Winnipeg, Manitoba. Some effort was made to collect potential species with specialised floral associations that were known from neighbouring jurisdictions. For example, specialist bees of *Amorpha* (Fabaceae) are known to occur in Minnesota, so targeted collection from this host plant took place. We also checked iNaturalist (www.iNaturalist.org) and Bumble Bee Watch (www.bumblebeewatch.org) and provide the unique code for observations supporting new records for the province.

Classification largely follows Michener (2007), except that we recognise subfamilies of Apidae supported by recent phylogenetic studies (Cardinal *et al.* 2010; Bossert *et al.* 2019), and subgenera of *Andrena* and *Lasioglossum* follow recent studies (Gibbs *et al.* 2012b, 2013; Pisanty *et al.* 2022). Michener (2000, 2007) recognised *Pterosarus* and *Heterosarus* as subgenera of *Protandrena*, but they have also been treated as subgenera or synonyms of *Pseudopanurgus* (Timberlake 1967; Ascher 2004; Ascher and Pickering 2020). Phylogenetic studies seem to suggest that a broadly defined *Pseudopanurgus* is paraphyletic (Bossert *et al.* 2021; Ramos *et al.* 2022). No *Pseudopanurgus sensu stricto* occur in Manitoba, but we implicitly use *Protandrena* as an umbrella genus for all North American Protandrenini. The following literature was used to identify specimens and determine taxon concepts: ***Andrena* Fabricius**: Mitchell (1960); LaBerge (1967, 1969, 1973, 1977, 1980, 1986, 1989); Ribble (1967, 1968, 1974); LaBerge and Bouseman (1970); LaBerge and Ribble (1972, 1975); Bouseman and LaBerge (1979); ***Calliopsis* Smith:** Rozen (1958); Mitchell (1960); Shinn (1967); ***Perdita* Smith:** Timberlake (1954, 1958, 1960, 1968); Mitchell (1960); ***Protandrena* Cockerell:** Mitchell (1960); Timberlake (1967, 1973, 1975); Scott *et al.* (2011); ***Bombus* Latreille:** Milliron (1971, 1973a, 1973b); Laverty and Harder (1988); Williams *et al.* (2008, 2014, 2019); Ghisbain et al. (2020); ***Brachymelecta* Linsley:** Hurd and Linsley (1951); Mitchell (1962); Onuferko *et al.* (2021); ***Diadasia* Patton:** Timberlake (1941); Adlakha (1969); Snelling (1994); ***Eucera***: Timberlake (1969); ***Melissodes* Latreille:** LaBerge (1956a, 1956b, 1961); Mitchell (1962); ***Holcopasites* Ashmead:** Hurd and Linsley (1972); ***Epeolus* Latreille:** Brumley (1965); Onuferko (2017, 2018); ***Triepeolus* Robertson:** Rightmyer (2008); ***Neolarra* Ashmead:** Michener (1939a); Shanks (1977); ***Nomada* Scopoli:** Cockerell (1903, 1905a, 1905b, 1908); Mitchell (1962); Broemeling (1988); Broemeling and Moalif (1988); Alexander and Schwarz (1994); Schwarz and Gusenleitner (2004); Droege *et al.* (2010); ***Epeoloides* Giraud:** Mitchell (1962); Packer *et al.* (2007); ***Ceratina* Latreille**: Mitchell (1962); Daly (1973); Rehan and Richards (2008); Rehan and Sheffield (2011);

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***Colletes* Latreille:** Stephen (1954); Mitchell (1960); ***Hylaeus* Fabricius:** Mitchell (1960); Snelling (1966, 1968, 1970); Oram (2018); ***Augochlorella* Sandhouse:** Mitchell (1960); Ordway (1966); Coelho (2004); ***Lasioglossum* Curtis:** McGinley (1986, 2003); Gibbs (2010, 2011); Gibbs *et al.* (2013); ***Sphecodes* Latreille:** Mitchell (1960); M. Arduser (unpublished data); ***Dufourea* Lepeletier**: Dumesh and Sheffield (2012); Gibbs *et al.* (2014); ***Anthidium* Fabricius:** Gonzalez and Griswold (2013); ***Dianthidium* Cockerell**: Mitchell (1962); Grigarick and Stange (1968); ***Stelis* Panzer:** Cockerell (1898); Sladen (1916b); Popov (1938); Mitchell (1962); ***Coelioxys* Latreille:** Mitchell (1962, 1980); Baker (1975); de Silva (2012); da Rocha Filho and Packer (2016); ***Megachile* Latreille**: Mitchell (1934, 1935a, 1935b, 1936, 1937a, 1937b, 1962); Parker (1978); Sheffield *et al.* (2011); Byzdk (2012); ***Ashmeadiella* Cockerell**: Michener (1939b); Hurd and Michener (1955); Mitchell (1962); Rowe (2017); ***Hoplitis* Klug**: Michener (1947); Mitchell (1962); Rowe (2017); ***Osmia* Panzer**: Sandhouse (1939); White (1952); Mitchell (1962); Rightmyer *et al.* (2010); and ***Macropis* Panzer**: Mitchell (1960); Michez and Patiny (2005). Some identifications were confirmed by colleagues with expertise in the relevant taxon. Zach Portman, University of Minnesota, confirmed the identification of *Perdita fallax* Cockerell from photographs. Karen Wright, Texas A&M University, College Station, Texas, United States of America, identified a synoptic set of *Melissodes* for Manitoba, which improved our taxon concepts. Terry Griswold, United States Department of Agriculture, Agriculture Research Service, verified and corrected identifications of a synoptic set of *Stelis*.

The checklist (Table 1) is ordered alphabetically by family, subfamily, tribe, genus, subgenus (where applicable), and species. Some species are flagged as provisional when plausible literature records could not be confirmed by examining voucher specimens or uncertain if the identification is doubtful. Material examined is provided for new Canadian and Manitoban records in Supplementary material S1. In some cases, "new" records are difficult to define because specimens may be recorded outside of the traditional scientific literature, either in theses (Patenaude 2007; Semmler 2015; Olynyk 2017) or within online databases. In addition, the collaborative nature of our research has meant that some bees first identified as part of this study, including new generic records for the province and new Canadian records, were released early to benefit other studies (Gardner and Gibbs 2021; Onuferko *et al.* 2021; Satyshur *et al.* 2021; Wrigley *et al.* 2021) or were being worked on simultaneously as part of graduate theses (Hanuschuk 2021; Miller 2021; Martini 2022). Our goal is to provide accessible, verifiable data for interesting records, even if there may be an earlier record outside of peer-reviewed publications. For this reason, we list as new records any species recorded during our research since the recent publication of a checklist of Canadian bees (Canadian Endangered Species Conservation Council 2015) but acknowledge their occurrence in other data sources. When many distinct collection events exist for a new species, only municipalities are provided, followed by the number of examined specimens. Intertegular spans (Cane 1987) for common species in southern Manitoba are provided for reference (Supplementary material S2). Measurements were taken using an ocular micrometer or a microscope-mounted camera and calculated using NIS-Elements (Nikon Instruments Inc., Melville, New York, United States of America). Historical records were georeferenced using online gazetteers and Google Earth (https://earth.google.com). The following abbreviations are used below in material examined sections: CFB, Canadian Forces Base; PF, provincial forest; PP, provincial park; and WMA, wildlife management area. The abbreviations for collections referred to below are as follows: AAFC, Brandon Research and Development Centre, Agriculture and Agri-Food Canada; AMNH, American Museum of Natural History; CMNC, Canadian Museum of Nature; CNC, Canadian National Collection of Insects, Arachnids, and Nematodes; INHS, Illinois Natural History Survey; MCDC, Manitoba Conservation Data Centre; and WRME, J.B. Wallis/R.E. Roughley Museum of Entomology.

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Table 1. Checklist of the bees of Manitoba. Data sources are indicated by superscripts (see Methods). New provincial records are indicated in bold text. New Canadian records are preceded by an asterisk. Exotic species are indicated using a superscript "E". The following abbreviations are used for behavioural data: sol., solitary; comm., communal; sub., subsocial; eus., eusocial; par., cleptoparasitic or socially parasitic; G, ground; W, wood; S, stems; H, hives; E, exterior surfaces; C, cavities; oligo., oliglolectic; and poly., polylectic. No lecty information is provided for parasites, although they may have limited pollen use by virtue of their hosts. The host column is used for plant taxa for oligolectic bees and bee taxa for brood parasites. It is likely that some oligolectic bees have host preferences for related taxa not included in the list. Similarly, records of a single bee host do not preclude additional undocumented hosts for cleptoparasites. Data sources are as follows: [1] primary literature, including taxonomic revisions and other studies found in peer-reviewed journals; [2] WRME (J.B. Wallis/R.E. Roughley Museum of Entomology) material – specimen confirmed; [3] unpublished theses and secondary sources (*e.g.*, nonpeer-reviewed literature). These are primarily theses (Patenaude 2007; Semmler 2015; Olynyk 2017) or country-wide checklists (Canadian Endangered Species Conservation Council 2015; Sheffield 2019) – only recorded when it does not occur in the primary literature; [4] AAFC (Agriculture and Agri-Food Canada) Brandon material – specimen confirmed; [5] CNC (Canadian National Collection) material – specimen confirmed; [6] CMNC (Canadian Museum of Nature collection) material – specimen confirmed; [7] recorded in a public database and housed at an external institution – specimen not examined; [8] images available on iNaturalist; and [9] INHS (Illinois Natural History Survey) material – specimen confirmed. ? indicates uncertainty.

Species	Nests	Substrate	Lecty	Floral or bee host
Andrenidae				
Andreninae				
Andrenini				
Andrena (*Andrena*) *clarkella* (Kirby, 1802)[1,2,5,8]	sol.	G	oligo.	*Salix*
Andrena (*Andrena*) *frigida* Smith, 1853[1,2,5,8,9]	sol.	G	oligo.	*Salix*
Andrena (*Andrena*) *milwaukeensis* Graenicher, 1903[1,2,5,8]	sol.	G	poly.	
Andrena (*Andrena*) *rufosignata* Cockerell, 1902[1,2]	sol.	G	poly.	
Andrena (*Andrena*) *thaspii* Graenicher, 1903[1,2,5,9]	sol.	G	poly.	
Andrena (*Callandrena s. l.*) *asteris* Robertson, 1891 (*simplex/solidiginis* group)[1,2,5,8]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Andrena (*Callandrena s. l.*) *helianthi* Robertson, 1891 (*helianthi* group)[1,2,5,8]	sol.	G	oligo.	*Helianthus*
***Andrena* (*Callandrena s. l.*) *placata* Mitchell, 1960** (*simplex/solidiginis* group)[2]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Andrena (*Cnemidandrena*) *canadensis* Dalla Torre, 1896 (*nubecula* group)[1,2,5]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Andrena (*Cnemidandrena*) *chromotricha* Cockerell, 1899 (*chromotricha* group)[1,2,9]	sol.	G	oligo.	Compositae
Andrena (*Cnemidandrena*) *hirticincta* Provancher, 1888 (*hirticincta* group)[1,2]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Andrena (*Cnemidandrena*) *nubecula* Smith, 1853 (*nubecula* group)[1,2]	sol.	G	oligo.	*Solidago, Symphyotrichum*
***Andrena* (*Cnemidandrena*) *parnassiae* Cockerell, 1902** (*scutellinitens* group)[2]	sol.	G	oligo.	*Parnassia*
Andrena (*Cnemidandrena*) *peckhami* Cockerell, 1902 (*chromotricha* group)[1]	sol.	G	poly.	Compositae
Andrena (*Cnemidandrena*) *robervalensis* Mitchell, 1960 (*scutellinitens* group)[1]	sol.	G	poly.	likely Compositae
***Andrena* (*Cnemidandrena*) *runcinatae* Cockerell, 1906** (*scutellinitens* group)[2,5]	sol.	G	poly.	likely Compositae

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Andrena* (*Conandrena*) *bradleyi* Viereck, 1907**[2]	sol.	G	oligo.	Ericaceae
Andrena (*Gonandrena*) *persimulata* Viereck, 1917[1,2,5]	sol.	G	oligo.	*Cornus*
Andrena (*Holandrena*) *cressonii cressonii* Robertson, 1891[1,2]	sol.	G	poly.	
Andrena (*Larandrena*) *miserabilis* Cresson, 1872[1,2,3,5]	sol.	G	poly.	
Andrena (*Leucandrena*) *barbilabris* (Kirby, 1802)[1,2,3.5,6]	sol.	G	poly.	
Andrena (*Melandrena*) *carlini* Cockerell, 1901[1,2,3,5]	sol.	G	poly.	
Andrena (*Melandrena*) *commoda* Smith, 1879[1,2]	sol.	G	poly.	
Andrena (*Melandrena*) *dunningi* Cockerell, 1898[1,2,5,8]	sol.	G	poly.	
Andrena (*Melandrena*) *erythrogaster* (Ashmead, 1890)[1,2,5,8,9]	sol.	G	oligo.	*Salix*
Andrena (*Melandrena*) *lupinorum* Cockerell, 1906[1,2,3,5]	sol.	G	oligo.	Fabaceae
Andrena (*Melandrena*) *nivalis* Smith, 1853[1,2,3,5]	sol.	G	poly.	
Andrena (*Melandrena*) *regularis* Malloch, 1917[1,2,3,5]	sol.	G	poly.	
Andrena (*Melandrena*) *vicina* Smith, 1853[1,2,3,5]	sol.	G	poly.	
Andrena (*Micrandrena*) *illinoiensis* Robertson, 1891 (*illinoiensis* group)[1,2,5]	sol.	G	poly.	
Andrena (*Micrandrena*) *melanochroa* Cockerell, 1898 (*piperi* group)[1,2,5]	sol.	G	oligo.	Rosaceae
***Andrena* (*Micrandrena*) *nigrae* Robertson, 1905** (*illinoiensis* group)[2]	sol.	G	oligo.	*Salix*
Andrena (*Micrandrena*) *salictaria* Robertson, 1905 (*illinoiensis* group)[1,2,3,5]	sol.	G	oligo.	*Salix*
Andrena (*Micrandrena*) *ziziae* Robertson, 1891 (*piperi* group)[1,2,5,9]	sol.	G	oligo.	*Zizia*
Andrena (*Parandrena*) *andrenoides* (Cresson, 1878)[1,2,5]	sol.	G	oligo.	*Salix*
Andrena (*Parandrena*) *wellesleyana* (Robertson, 1897)[1,2,5,8]	sol.	G	oligo.	*Salix*
***Andrena* (*Plastandrena*) *crataegi* Robertson, 1893** (*crataegi* group)[2,5]	sol.	G	poly.	
Andrena (*Plastandrena*) *prunorum prunorum* Cockerell, 1896 (*prunorum* group)[1,2,5,6]	sol.	G	poly.	
Andrena (*Ptilandrena*) *algida* Smith, 1853[1,2,3,5,9]	sol.	G	poly.	
***Andrena* (*Ptilandrena*) cf. *campanulae* Viereck and Cockerell, 1914**[2]	sol.	G	oligo. (?)	
Andrena (*Ptilandrena*) *nigrihirta* (Ashmead, 1890)[1,2,5,9]	sol.	G	poly.	
Andrena (*Ptilandrena*) aff. *nigrihirta*[2,3]	sol.	G		
Andrena (*Scrapteropsis*) *alleghaniensis* Viereck, 1907 (*alleghaniensis* group)[1,2,8]	sol.	G	poly.	
Andrena (*Scrapteropsis*) *imitatrix* Cresson, 1872 (*imitatrix* group)[1,2,5,9]	sol.	G	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Andrena (*Simandrena*) *wheeleri* Graenicher, 1904[1,2,5]	sol.	G	poly.	
***Andrena* (*Taeniandrena*) *wilkella* (Kirby, 1802)**[E,2,5,8]	sol.	G	oligo.	Fabaceae
Andrena (*Thysandrena*) *medionitens* Cockerell, 1902[1,2,5]	sol.	G	poly.	
Andrena (*Thysandrena*) *w-scripta* Viereck, 1904[1,2,5]	sol.	G	poly.	
Andrena (*Trachandrena*) *cyanophila* Cockerell, 1906 [2,3]	sol.	G	poly.	
Andrena (*Trachandrena*) *forbesii* Robertson, 1891[1,2,5]	sol.	G	poly.	
Andrena (*Trachandrena*) *hippotes* Robertson, 1895[1,2,5,8]	sol.	G	poly.	
Andrena (*Trachandrena*) *mariae* Robertson, 1891[1,2,5,9]	sol.	G	oligo.	*Salix*
Andrena (*Trachandrena*) *miranda* Smith, 1879[1,2,5]	sol.	G	poly.	
Andrena (*Trachandrena*) *sigmundi* Cockerell, 1902[1,2,5,9]	sol.	G	oligo.	*Salix*
Panurginae				
Calliopsini				
Calliopsis (*Calliopsima*) *coloradensis* Cresson, 1878[1,2]	sol.	G	oligo.	Compositae
***Calliopsis* (*Calliopsis*) *andreniformis* Smith, 1853[2,3,9]**	sol.	G	poly.	
****Calliopsis* (*Nomadopsis*) *australior* Cockerell, 1897**[2,3,4]	sol.	G	unk.	
Perditini				
Perdita (*Cockerellia*) *albipennis* Cresson, 1868 *canadensis* Crawford, 1912[1,2,6,8]	sol.	G	oligo.	*Helianthus*
Perdita (*Perdita*) *bruneri* Cockerell, 1897 (*octomaculata* group)[1,2]	sol.	G	oligo.	Compositae
***Perdita* (*Perdita*) *fallax* Cockerell, 1896** (*octomaculata* group)[6]	sol.	G	oligo.	*Helianthus*
Perdita (*Perdita*) *halictoides* Smith, 1853 (*halictoides* group)[1,2,5]	sol.	G	oligo.	*Physalis*
Perdita (*Perdita*) *maculigera* Cockerell, 1896 *maculipennis* Graenicher, 1910 (*octomaculata* group)[1,2,9]	sol.	G	oligo.	*Salix*
Perdita (*Perdita*) *octomaculata* (Say, 1824) (*octomaculata* group)[1]	sol.	G	oligo.	*Solidago*
Perdita (*Perdita*) *perpallida perpallida* Cockerell, 1901 (*octomaculata* group)[1,2,6,8]	sol.	G	oligo.	*Dalea*
Perdita (*Perdita*) *swenki* Crawford, 1915 (*octomaculata* group)[1,2,6,8]	sol.	G	oligo.	*Solidago*
****Perdita* (*Perdita*) *tridentata* Stevens, 1919** (*octomaculata* group)[2,6]	sol.	G	oligo.	*Helianthus*
Protandrenini				
Protandrena (*Heterosarus*) *parva* (Robertson, 1892)[2,3]	sol.	G	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Protandrena (*Pterosarus*) *aestivalis* (Provancher, 1882)[3,7]	sol.	G	oligo.	Compositae: Astereae
***Protandrena* (*Pterosarus*) *albertensis* (Cockerell, 1937)**[2]	sol.	G	oligo.	Compositae: Cichorieae (?)
***Protandrena* (*Pterosarus*) *albitarsis* (Cresson, 1872)**[2,3]	sol.	G	oligo.	Compositae: Heliantheae
Protandrena (*Pterosarus*) *perlaevis* (Cockerell, 1896)[2,3]	sol.	G	oligo.	*Helianthus*
***Protandrena* (*Pterosarus*) *piercei* (Crawford, 1903)**[2,5]	sol.	G	oligo.	*Helianthus*
Protandrena (*Pterosarus*) *renimaculata* (Cockerell, 1896)[2,3]	sol.	G	oligo.	*Grindelia*
Protandrena (*Pterosarus*) *rudbeckiae* (Robertson, 1895)[1]	sol.	G	oligo.	*Rudbeckia*
Apidae				
Anthophorinae				
Anthophora (*Clisodon*) *terminalis* Cresson, 1869[1,2,5,8,9]	sol.	W	poly.	
Anthophora (*Melea*) *bomboides* Kirby, 1838 (*bomboides* group)[1,2,8]	sol.	G	poly.	
Anthophora (*Melea*) *occidentalis* Cresson, 1869 (*bomboides* group)[1,2]	sol.	G	poly.	
Anthophora (*Mystacanthophora*) *walshii* Cresson, 1869 (*montana* group)[2,3]	sol.	G	poly.	
Apinae				
Apini				
Apis (*Apis*) *mellifera* Linnaeus, 1758[E,1,2,6,8]	eus.	H	poly.	
Bombini				
Bombus (*Alpinobombus*) *kirbiellus* Curtis, 1835[1,2]	eus.	H	poly.	
Bombus (*Alpinobombus*) *polaris* Curtis, 1835[1,2,9]	eus.	H	poly.	
Bombus (*Bombias*) *nevadensis* Cresson, 1874[1,2,5,8]	eus.	H	poly.	
Bombus (*Bombus*) *terricola* Kirby, 1837[1,2,5,8.9]	eus.	H	poly.	
Bombus (*Cullumanobombus*) *griseocollis* (De Geer, 1773)[1,2,5,6,8,9]	eus.	H	poly.	
Bombus (*Cullumanobombus*) *rufocinctus* Cresson, 1863[1,2,5,8,9]	eus.	H	poly.	
Bombus (*Psithyrus*) *bohemicus* Seild, 1838/ *ashtoni* (Cresson, 1864)[1,2,8,9]	par.	H	NA	*Bombus* (*Bombus*)
Bombus (*Psithyrus*) *citrinus* (Smith, 1854)[1,2,5]	par.	H	NA	*Bombus bimaculatus, B. impatiens, B. vagans*
Bombus (*Psithyrus*) *flavidus* Eversmann, 1852[1,2,5,8]	par.	H	NA	*Bombus*
Bombus (*Psithyrus*) *insularis* (Smith, 1861)[1,2,5,6]	par.	H	NA	*Bombus*
Bombus (*Psithyrus*) *suckleyi* Greene, 1860[1,2]	par.	H	NA	*Bombus*

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Bombus (*Pyrobombus*) *bimaculatus* Cresson, 1863[1,2,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *centralis* Cresson, 1864[1,2]	eus.	H	poly.	
Bombus (*Pyrobombus*) *flavifrons* Cresson, 1863[1,2,5,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *frigidus* Smith, 1854[1,2,5,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *huntii* Greene, 1860[1,2,8]	eus.	H	poly.	
***Bombus* (*Pyrobombus*) *impatiens* Cresson, 1863**[3,E]	eus.	H	poly.	
Bombus (*Pyrobombus*) *jonellus* (Kirby, 1802)[1,2,5]	eus.	H	poly.	
Bombus (*Pyrobombus*) *melanopygus* Nylander, 1848[1,2,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *mixtus* Cresson, 1878[1,2]	eus.	H	poly.	
Bombus (*Pyrobombus*) *perplexus* Cresson, 1863[1,2,5,8,9]	eus.	H	poly.	
Bombus (*Pyrobombus*) *sandersoni* Franklin, 1913[1,2,5,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *sylvicola* Kirby, 1837[1,2,8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *ternarius* Say, 1837[1,2,5,6.8]	eus.	H	poly.	
Bombus (*Pyrobombus*) *vagans vagans* Smith, 1854[1,2,5,8,9]	eus.	H	poly.	
Bombus (*Pyrobombus*) *vancouverensis* Cresson, 1878[1,5]	eus.	H	poly.	
Bombus (*Subterraneobombus*) *borealis* Kirby, 1837[1,2,5,6,8]	eus.	H	poly.	
Bombus (*Thoracobombus*) *fervidus* (Fabricius, 1798)[1,2,8]	eus.	H	poly.	
Bombus (*Thoracobombus*) *pensylvanicus* (De Geer, 1773)[1,5]	eus.	H	poly.	
Eucerinae				
Emphorini				
Diadasia (*Coquillettapis*) *australis australis* (Cresson, 1878)[1,2]	sol.	G	oligo.	*Opuntia*
***Diadasia* (*Coquillettapis*) *diminuta* (Cresson, 1878)**[2]	sol.	G	oligo.	*Sphaeralcea*
****Diadasia* (*Dasiapis*) *ochracea* (Cockerell, 1903)**[2]	sol.	G	oligo.	*Sphaeralcea* and related genera
Eucerini				
***Eucera* (*Synhalonia*) *atriventris* (Smith, 1854)**[2]	sol.	G	poly.	
***Eucera* (*Synhalonia*) cf. *chrysobotryae* (Cockerell, 1908)**[2]	sol.	G	poly.	
***Eucera* (*Synhalonia*) *hamata* (Bradley, 1942)**[2]	sol.	G	poly.	
Melissodes (*Eumelissodes*) *agilis* Cresson, 1878[1,2,6]	sol.	G	oligo.	*Helianthus*
****Melissodes* (*Eumelissodes*) *bidentis* Cockerell, 1914**[2]	sol.	G	oligo.	Compositae
Melissodes (*Eumelissodes*) *confusus* Cresson, 1878[1,2,5]	sol.	G	oligo.	Compositae
***Melissodes* (*Eumelissodes*) *coreopsis* Robertson, 1905**[2]	sol.	G	oligo.	Compositae

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Melissodes* (*Eumelissodes*) *denticulatus* Smith, 1854**[2]	sol.	G	oligo.	*Vernonia*
Melissodes (*Eumelissodes*) *druriellus* (Kirby, 1802)[1,2,5]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Melissodes (*Eumelissodes*) *illatus* Lovell and Cockerell, 1906[1,2,5]	sol.	G	oligo.	Compositae
***Melissodes* (*Eumelissodes*) *menuachus* Cresson, 1868**[2]	sol.	G	oligo.	Compositae
Melissodes (*Eumelissodes*) *pallidisignatus* Cockerell, 1905[2,3]	sol.	G	oligo.	Compositae
Melissodes (*Eumelissodes*) *perlusus* Cockerell, 1925[1,2,5]	sol.	G	oligo.	Compositae
Melissodes (*Eumelissodes*) *snowii* Cresson, 1872[1,2,5,6]	sol.	G	oligo.	Compositae
***Melissodes* (*Eumelissodes*) *subagilis* Cockerell, 1905**[2]	sol.	G	oligo.	Compositae
Melissodes (*Eumelissodes*) *subillatus* LaBerge, 1961[1,2,5]	sol.	G	oligo.	Compositae
***Melissodes* (*Eumelissodes*) *trinodis* Robertson, 1901**[2,8]	sol.	G	oligo.	*Helianthus* and related Compositae
Melissodes (*Eumelissodes*) *wheeleri* Cockerell, 1906[2]	sol.	G	oligo.	Compositae
***Melissodes* (*Heliomelissodes*) *desponsus* Smith, 1854**[2]	sol.	G	oligo.	*Cirsium*
Melissodes (*Heliomelissodes*) *rivalis* Cresson, 1872[2,3]	sol.	G	oligo.	*Cirsium*
***Melissodes* (*Melissodes*) *bimaculatus bimaculatus* (Lepeletier, 1825)**[2,8]	sol.	G	poly.	
Nomadinae				
Ammobatoidini				
***Holcopasites calliopsidis calliopsidis* (Linsley, 1943)**[2,8]	par.	G	NA	*Calliopsis andreniformis*
***Holcopasites heliopsis* (Robertson, 1897)**[2,5]	par.	G	NA	*Calliopsis*?
Holcopasites stevensi Crawford, 1915[2,5,6]	par.	G	NA	*Calliopsis*
Epeolini				
Epeolus ainsliei Crawford, 1932[1,2,5,8]	par.	G	NA	likely *Colletes susannae* and possibly *C. wilmattae*
Epeolus americanus (Cresson, 1878)[1,2,5]	par.	G	NA	*Colletes consors mesocopus*
Epeolus compactus Cresson, 1878[1,2]	par.	G	NA	*Colletes kincaidii*
Epeolus gibbsi Onuferko, 2018[1,2]	par.	G	NA	*Colletes*
Epeolus interruptus Robertson, 1900[1,2,5]	par.	G	NA	*Colletes aestivalis, C. brevicornis*, and *C. willistoni* are possible hosts
Epeolus minimus (Robertson, 1902)[1,2,5]	par.	G	NA	*Colletes kincaidii* is a likely host
Epeolus scutellaris Say, 1824[1,2]	par.	G	NA	likely *Colletes simulans armatus*
***Triepeolus eliseae* Rightmyer, 2017**[2]	par.	G	NA	possibly *Melissodes* (*Eumelissodes*)

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Triepeolus* cf. *grindeliae* Cockerell, 1907**[2]	par.	G	NA	possibly *Melissodes* (*Eumelissodes*)
***Triepeolus helianthi* (Robertson, 1897)**[2]	par.	G	NA	*Melissodes* (*Eumelissodes*) and Nomiinae
***Triepeolus michiganensis* Mitchell, 1962**[2]	par.	G	NA	Likely *Melissodes* (*Eumelissodes*)
***Triepeolus obliteratus* Graenicher, 1911**[2,8]	par.	G	NA	Likely *Melissodes* (*Eumelissodes*)
***Triepeolus occidentalis* (Cresson, 1878)**[2]	par.	G	NA	*Melissodes*, possibly *M. menuachus*
***Triepeolus pectoralis* (Robertson, 1897)**[2,3]	par.	G	NA	*Melissodes druriellus*
***Triepeolus subalpinus* Cockerell, 1910**[2]	par.	G	NA	*Melissodes* (*Eumelissodes*), possibly *M. agilis*
Epeoloidini				
Epeoloides pilosulus (Cresson, 1878)[1,2]	par.	G	NA	*Macropis*
Melectini				
***Brachymelecta californica* (Cresson, 1878)**[2]	par.	G	NA	*Anthophora*
***Brachymelecta interrupta* (Cresson, 1872)**[2]	par.	G	NA	*Anthophora walshii*
Neolarrini				
***Neolarra* (*Phileremulus*) *vigilans* Cockerell, 1895**[2,6]	par.	G	NA	*Perdita*
***Neolarra* (*Phileremulus*) *mallochi* (Crawford, 1912)**[2]	par.	G	NA	*Perdita*
Nomadini				
***Nomada alpha* Cockerell, 1905** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Nomada aquilarum Cockerell, 1903 (*roberjeotiana* group)[1,2]	par.	G	NA	*Andrena* (*Cnemidandrena*) (?)
***Nomada articulata* Smith, 1854** (*erigeronis* group)[2]	par.	G	NA	*Agapostemon*
***Nomada australis* Mitchell, 1962** (*erigeronis* group)[2]	par.	G	NA	*Agapostemon splendens* (?)
***Nomada banksi* Cockerell, 1907** (*ruficornis* group)[2]	par.	G	NA	*Andrena asteris* (?)
***Nomada composita* Mitchell, 1962** (*ruficornis* group)	par.	G	NA	
***Nomada crawfordi crawfordi* Cockerell, 1905** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Nomada cressonii Robertson, 1893 (*ruficornis* group)[1,2]	par.	G	NA	*Andrena* (*Melandrena, Plastandrena*)
Nomada cuneata (Robertson, 1903) (*ruficornis* group: bidentate mandible)[1,2]	par.	G	NA	*Andrena vicina*
***Nomada denticulata* Robertson, 1902** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
***Nomada depressa* Cresson, 1863** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
***Nomada fervida* Smith, 1854** (*vegana* group)[2,8]	par.	G	NA	*Andrena* (?)
***Nomada* cf. *florilega* Lovell and Cockerell, 1905**[2,3]	par.	G	NA	*Andrena* (?)
***Nomada fuscicincta* Swenk, 1915** (*ruficornis* group: bidentate mandible)[2]	par.	G	NA	*Andrena ziziae* (?)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Nomada gracilis* Cresson, 1863** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Nomada imbricata Smith, 1854 (*ruficornis* group)[1,2,8]	par.	G	NA	*Andrena* (*Melandrena*)
***Nomada integerrima* Dalla Torre, 1896** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Nomada lehighensis Cockerell, 1903 (*ruficornis* group)[2,3]	par.	G	NA	*Andrena* (?)
***Nomada luteoloides* Robertson, 1895** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (*Melandrena*)
Nomada maculata Cresson, 1863 (*ruficornis* group: bidentate mandible)[2,3]	par.	G	NA	*Andrena* (*Melandrena*)
***Nomada obliterata* Cresson, 1863** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
***Nomada ovata* (Robertson, 1903)** (*ruficornis* group: bidentate mandible)[2,3]	par.	G	NA	*Andrena* (?)
***Nomada quadrimaculata* (Robertson, 1903)** (*ruficornis* group: bidentate mandible)[2]	par.	G	NA	*Andrena* (?)
***Nomada rubicunda* Olivier, 1811** (*erigeronis* group)[2,6]	par.	G	NA	*Agapostemon splendens*
****Nomada sphaerogaster* Cockerell, 1903** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
***Nomada valida* Smith, 1854** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
***Nomada vicina* Cresson, 1863** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Nomada vincta Say, 1837 (*vincta* group)[1,2]	par.	G	NA	*Andrena helianthi*
****Nomada xantholepis* Cockerell, 1911** (*ruficornis* group)[2]	par.	G	NA	*Andrena* (?)
Xylocopinae				
Ceratinini				
Ceratina (*Zadontomerus*) *calcarata* Robertson, 1900[1,2]	sub.	S	poly.	
Ceratina (*Zadontomerus*) *dupla* Say, 1837[1,2]	sub.	S	poly.	
***Ceratina* (*Zadontomerus*) *mikmaqi* Rehan and Sheffield, 2011**[2,6]	sub.	S	poly.	
Colletidae				
Colletinae				
Colletini				
Colletes americanus Cresson, 1868 (*americanus* group)[1,2,5]	sol.	G	oligo.	Compositae
Colletes andrewsi Cockerell, 1906 (*aestivalis* group)[1,2,5,8]	sol.	G	oligo.	*Heuchera*
Colletes brevicornis Robertson, 1897 (*willistoni* group)[1,2,5,8]	sol.	G	oligo.	*Campanula*
Colletes consors mesoscopus Swenk, 1907 (*consors* group)[1,2]	sol.	G	oligo.	*Phacelia*

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Colletes hyalinus hyalinus* Provancher, 1888** (*hyalinus* group)[2,5]	sol.	G	poly.	
***Colletes impunctatus lacustris* Swenk, 1906** (*clypearis* group)[2]	sol.	G	oligo.	*Gaylussacia*
Colletes inaequalis Say, 1837 (*inaequalis* group)[1,2,5,8]	sol.	G	poly.	
Colletes kincaidii Cockerell, 1898 (*simulans* group)[1,2,5]	sol.	G	poly.	
Colletes nigrifrons Titus, 1900 (*consors* group)[5,7 (AMNH)]	sol.	G	poly.	
Colletes petalostemonis Swenk, 1906 (*daleae* group)[1]	sol.	G	oligo.	*Dalea*
Colletes phaceliae Cockerell, 1906 (*hyalinus* group)[1]	sol.	G	poly.	
Colletes robertsonii Dalla Torre, 1896 (*robertsonii* group)[1,2,5]	sol.	G	oligo.	Fabaceae
Colletes rufocinctus Cockerell, 1929 (*simulans* group)[1,2]	sol.	G	oligo.	Compositae
Colletes simulans armatus Patton, 1879 (*simulans* group)[1,2,5]	sol.	G	oligo.	*Solidago, Symphyotrichum*
Colletes susannae Swenk, 1925 (*americanus* group)[1,2,5,8]	sol.	G	oligo.	*Dalea*
***Colletes validus* Cresson, 1868** (*inaequalis* group)[2,5]	sol.	G	oligo.	Ericaceae
Colletes willistoni Robertson, 1895 (*willistoni* group)[1,2,5]	sol.	G	oligo.	*Physalis*
Colletes wilmattae Cockerell, 1904 (*americanus* group)[1,2,5,6]	sol.	G	oligo.	*Dalea*
Hylaeinae				
Hylaeini				
Hylaeus (*Cephalylaeus*) *basalis* (Smith, 1853)[1,2,5]	sol.	S	poly.	Rosaceae
Hylaeus (*Hylaeus*) *annulatus* (Linnaeus, 1758) (*annulatus* group)[2,3,5,8]	sol.	S	poly.	Rosaceae
Hylaeus (*Hylaeus*) aff. *rudbeckiae* (Cockerell and Casad, 1895) (*rudbeckiae* group)[2]	sol.	S	poly.	
***Hylaeus* (*Hylaeus*) *fedorica* (Cockerell, 1909)** (*rudbeckiae* group)[2]	sol.	S	poly.	
Hylaeus (*Hylaeus*) *leptocephalus* (Morawitz, 1871 ["1870"]) (*leptocephalus* group)[E,2,3]	sol.	S	poly.	Fabaceae
Hylaeus (*Hylaeus*) *mesillae cressoni* (Cockerell, 1907) (*rudbeckiae* group)[2,3,5]	sol.	S	poly.	
***Hylaeus* (*Hylaeus*) *rudbeckiae* Cockerell and Casad, 1895** (*rudbeckiae* group)[2,5]	sol.	S	poly.	
***Hylaeus* (*Hylaeus*) *saniculae* (Robertson, 1896)** (*rudbeckiae* group)[2]	sol.	S	poly.	
Hylaeus (*Hylaeus*) *verticalis* (Cresson, 1869) (*verticalis* group)[2,3,5]	sol.	S	poly.	
Hylaeus (*Prosopis*) *affinis* (Smith, 1853)[1,2,8]	sol.	S	poly.	
***Hylaeus* (*Prosopis*) cf. *gaigei* (Cockerell, 1916)**[2]	sol.	S	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Hylaeus (*Prosopis*) *illinoisensis* (Robertson, 1896) [2,3]	sol.	S	poly.	
Hylaeus (*Prosopis*) *modestus modestus* Say, 1837[2,3,8]	sol.	S	poly.	
Hylaeus (*Prosopis*) *nelumbonis* (Robertson, 1890)[2,3]	sol.	S	poly.	
***Hylaeus* (*Prosopis*) sp. A**[2]	sol.	S	poly.	
Halictidae				
Halictinae				
Augochlorini				
Augochlorella aurata (Smith, 1853)[1,2,5,8]	eus.	G	poly.	
Halictini				
Agapostemon (*Agapostemon*) *sericeus* (Forster, 1771) (*sericeus* group)[1,2,5,8]	sol.	G	poly.	
Agapostemon (*Agapostemon*) *splendens* (Lepeletier, 1841) (*splendens* group)[1,2,5,6]	sol.	G	poly.	
Agapostemon (*Agapostemon*) *texanus* Cresson, 1872 (*splendens* group)[1,2,5,6,8]	sol.	G	poly.	
Agapostemon (*Agapostemon*) *virescens* (Fabricius, 1775)[1,2,8]	com.	G	poly.	
Halictus (*Nealictus*) *parallelus* Say, 1837[1,2]	eus.	G	poly.	
Halictus (*Odontalictus*) *ligatus* Say, 1837[1,2]	eus.	G	poly.	
Halictus (*Protohalictus*) *rubicundus* (Christ, 1791)[1,2,5,8]	eus.	G	poly.	
Halictus (*Seladonia*) *confusus confusus* Smith, 1853[1,2,8]	eus.	G	poly.	
Halictus (*Seladonia*) *virgatellus* Cockerell, 1901[1,2]	sol.	G	poly.	
***Lasioglossum* (*Dialictus*) *absimile* (Sandhouse, 1924)** (*viridatum* group)[1,2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *admirandum* (Sandhouse, 1924)** (*viridatum* group)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *albipenne* (Robertson, 1890)[1,2,6]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *albohirtum* (Crawford, 1907)**[4]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *cressonii* (Robertson, 1890)[2,3]	eus.?	W	poly.	
***Lasioglossum* (*Dialictus*) *dreisbachi* (Mitchell, 1960)** (*viridatum* group)[2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *ellisiae* (Sandhouse, 1924)** (*gemmatum* group)[2]	sol.?	G	poly.	
***Lasioglossum* (*Dialictus*) *ephialtum* Gibbs, 2010** (*viridatum* group)[2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *imitatum* (Smith, 1853)[1,2]	eus.	G	poly.	
***Lasioglossum* (*Dialictus*) *immigrans* Gardner and Gibbs, 2021[1,2]**	eus.?	G	poly	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Lasioglossum (*Dialictus*) *laevissimum* (Smith, 1853)[1,2,8,9]	eus.	G	poly.	
***Lasioglossum* (*Dialictus*) *leucocomus* (Lovell, 1908)**[2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *lineatulum* (Crawford, 1906)[1,2]	eus.	G	poly.	
***Lasioglossum* (*Dialictus*) *michiganense* (Mitchell, 1960)** (*platyparium* group)[2]	par.	G	NA	*Lasioglossum* (*Dialictus*)
Lasioglossum (*Dialictus*) *nigroviride* (Graenicher, 1910)[1,2,8]	eus.?	W	poly.	
Lasioglossum (*Dialictus*) *novascotiae* (Mitchell, 1960) (*viridatum* group)[2,3]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *oblongum* (Lovell, 1905)** (*viridatum* group)[2]	eus.?	W	poly.	
Lasioglossum (*Dialictus*) *occidentale* (Crawford, 1902) (*anomalum* group)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *packeri* Gibbs, 2010[1,5]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *pavoninum* (Ellis, 1913)[1,5]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *perpunctatum* (Ellis, 1913)[1,2,9]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *pictum* (Crawford, 1902)[1,2,6]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *pilosum* (Smith, 1853)**[1,2,3,8,9]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *planatum* (Lovell, 1905)** (*viridatum* group)[2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *prasinogaster* Gibbs, 2010** (*veganum* group)[2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *pruinosum* (Robertson, 1892)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *rufulipes* (Cockerell, 1938) (*testaceum* group)[1,2]	sol.?	G	poly.	
Lasioglossum (*Dialictus*) *sagax* (Sandhouse, 1924) (*viridatum* group)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *semicaeruleum* (Cockerell, 1895)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *sheffieldi* Gibbs, 2010 (*perdifficile* group)[1,2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *sitocleptum* Gibbs, 2010** (*platyparium* group)[2]	par.	G	NA	*Lasioglossum* (*Dialictus*)
***Lasioglossum* (*Dialictus*) *subversans* (Mitchell, 1960)**[1,2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *subviridatum* (Cockerell, 1938)** (*viridatum* group)[2]	eus.?	W	poly.	
Lasioglossum (*Dialictus*) *succinipenne* (Ellis, 1913)[1,2]	eus.?	G	poly.	
***Lasioglossum* (*Dialictus*) *taylorae* Gibbs, 2010** (*viridatum* group)[2]	eus.?	G	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Lasioglossum* (*Dialictus*) *tenax* (Sandhouse, 1924)**[2]	sol.	G	poly.	
Lasioglossum (*Dialictus*) *timothyi* Gibbs, 2010[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *versans* (Lovell, 1905) (*ruidosense* group)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *versatum* (Robertson, 1902)[1,2]	eus.	G	poly.	
Lasioglossum (*Dialictus*) *vierecki* (Crawford, 1904)[1,2,6,8]	sol.	G	poly.	
Lasioglossum (*Dialictus*) *viridatum* Lovell, 1905 (*viridatum* group)[1,2]	eus.?	G	poly.	
Lasioglossum (*Dialictus*) *zephyrus* (Smith, 1853)[1,2,8]	eus.	G	poly.	
Lasioglossum (*Evylaeus*) *cinctipes* (Provancher, 1888)[1,2]	eus.	G	poly.	
Lasioglossum (*Hemihalictus*) *foxii* (Robertson, 1895)[2,6,8]	sol.	G	poly.	
Lasioglossum (*Hemihalictus*) *inconditum* (Cockerell, 1916)[1,2]	sol.	G	poly.	
Lasioglossum (*Hemihalictus*) *macoupinense* (Robertson, 1895)[1,2]	sol.	G	poly.	
***Lasioglossum* (*Hemihalictus*) *nelumbonis* (Robertson, 1890)**[2]	sol.	G	oligo.	
Lasioglossum (*Hemihalictus*) *pectorale* (Smith, 1853)[1,2,6]	sol.	G	poly.	
Lasioglossum (*Hemihalictus*) *swenki* (Crawford, 1906)[1,2,6]	sol.	G	poly.	
***Lasioglossum* (*Lasioglossum*) *acuminatum* McGinley, 1986** (*forbesii* group)[2,9]	sol.	G	poly.	
Lasioglossum (*Lasioglossum*) *athabascense* (Sandhouse, 1933)[1,2]	sol.	G	poly.	
Lasioglossum (*Lasioglossum*) *coriaceum* (Smith, 1853)[1,2]	sol.	G	poly.	
Lasioglossum (*Lasioglossum*) *paraforbesii* McGinley, 1986 (*forbesii* group)[1,2,6]	sol.	G	poly.	
Lasioglossum (*Leuchalictus*) *leucozonium* (Schrank, 1781)[E,2,3,6]	sol.	G	poly.	
Lasioglossum (*Leuchalictus*) *zonulus* (Smith, 1848)[E,1,2,6,8,9]	sol.	G	poly.	
Lasioglossum (*Sphecodogastra*) *aberrans* (Crawford, 1903) (*lusorium* group)[1]	sol.	G	oligo.	Onagraceae
Lasioglossum (*Sphecodogastra*) *boreale* Svensson, Ebmer and Sakagami, 1977 (*fulvicorne/fratellum* group)[1,2]	sol.	G	poly.	
***Lasioglossum* (*Sphecodogastra*) *comagenense* (Knerer and Atwood, 1964)** (*fulvicorne/fratellum* group)[2]	com.	G	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
***Lasioglossum* (*Sphecodogastra*) *lusorium* (Cresson, 1872)** (*lusorium* group)[4]	sol.	G	oligo.	Onagraceae
***Lasioglossum* (*Sphecodogastra*) *quebecense* (Crawford, 1907)** (*fulvicorne/fratellum* group)[2]	sol.	G	poly.	
***Lasioglossum* (*Sphecodogastra*) *seillean* Gibbs and Packer, 2013** (*fulvicorne/fratellum* group)[2]	sol.?	G	poly.	
***Lasioglossum* (*Sphecodogastra*) *truncatum* (Robertson, 1901)**[2]	eus.	G	poly.	
***Sphecodes atlantis* Mitchell, 1956** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes banksii* Lovell, 1909** (*mandibularis* group)[2]	par.	G	NA	*Lasioglossum vierecki*
Sphecodes clematidis Robertson, 1897 (*dichrous* group)[2,3]	par.	G	NA	
***Sphecodes confertus* Say, 1837** (*confertus* group)[2,6]	par.	G	NA	
***Sphecodes coronus* Mitchell, 1956** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes cressonii* (Robertson, 1903)** (*mandibularis* group)[2]	par.	G	NA	
Sphecodes davisii Robertson, 1897 (*mandibularis* group)[2,3]	par.	G	NA	
***Sphecodes dichrous* Smith, 1853** (*dichrous* group)[2]	par.	G	NA	
***Sphecodes* cf. *galerus* Lovell and Cockerell, 1907** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes illinoensis* (Robertson, 1903)** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes johnsonii* Lovell, 1909** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes levis* Lovell and Cockerell, 1907** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes mandibularis* Cresson, 1872** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes pecosensis pecosensis* Cockerell, 1904** (*ranunculi* group)[2]	par.	G	NA	
***Sphecodes prosphorus* Lovell and Cockerell, 1907** (*dichrous* group)[2]	par.	G	NA	
***Sphecodes pycnanthemi* Robertson, 1897** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes smilacinae* Robertson, 1897** (*mandibularis* group)[2]	par.	G	NA	
***Sphecodes solonis* Graenicher, 1910** (*dichrous* group)[2]	par.	G	NA	
***Sphecodes townesi* Mitchell, 1956** (*mandibularis* group)[2]	par.	G	NA	
Nomiinae				
Dieunomiini				

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Dieunomia (*Dieunomia*) *heteropoda heteropoda* (Say, 1824)[1,5]	sol.	G	oligo.	*Helianthus* (+)
Rophitinae				
Rophitini				
***Dufourea harveyi* (Cockerell, 1906)**[2]	sol.	G	oligo.	*Potentilla*
Dufourea marginata marginata (Cresson, 1878)[1,2]	sol.	G	oligo.	*Helianthus*
Dufourea maura (Cresson, 1878)[1,2,8]	sol.	G	oligo.	*Campanula*
Megachilidae				
Megachilinae				
Anthidiini				
Anthidium (*Anthidium*) *clypeodentatum* Swenk, 1914[1,2,5,6,8]	sol.	G	poly.	Fabaceae
***Anthidium* (*Anthidium*) *manicatum manicatum* Linnaeus, 1758**[E, 2,8]	sol.	C	poly.	
Anthidium (*Anthidium*) *tenuiflorae* Cockerell, 1907[1,2]	sol.	G	poly.	*Phacelia*
****Dianthidium* (*Dianthidium*) *parvum* (Cresson, 1878)**[2,6]	sol.	E	oligo.	
Dianthidium (*Dianthidium*) *pudicum pudicum* (Cresson, 1879)[1,2]	sol.	E	oligo.	
Dianthidum (*Dianthidium*) *simile* (Cresson, 1864)[1,2]	sol.	G	oligo.	
***Stelis* (*Stelis*) *coarctatus* Crawford, 1916**[2,7,8]	par.	C	NA	*Heriades*, *Hoplitis*
***Stelis* (*Stelis*) *foederalis* Smith, 1854**[2,7]	par.	C	NA	*Hoplitis, Osmia*
Stelis (*Stelis*) *labiata* (Provancher, 1888)[1,2]	par.	C	NA	*Hoplitis*
Stelis (*Stelis*) *lateralis* Cresson, 1864[1,2]	par.	C	NA	*Hoplitis*
***Stelis* (*Stelis*) aff. *interrupta* Cresson, 1897**[2]	par.	C	NA	
***Stelis* (*Stelis*) *nitida* Cresson, 1878**[2]	par.	C	NA	
***Stelis* (*Stelis*) *permaculata* Cockerell, 1898**[1,2]	par.	C	NA	*Heriades carinata*
Stelis (*Stelis*) *subemarginata* Cresson, 1878[1]	par.	C	NA	*Hoplitis, Osmia*
Megachilini				
Coelioxys (*Boreocoelioxys*) *moestus* Cresson, 1864[1,2,5]	par.	C	NA	*Megachile*
Coelioxys (*Boreocoelioxys*) *octodentatus* Say, 1824[1,2,5,6]	par.	G	NA	*Megachile*
Coelioxys (*Boreocoelioxys*) *porterae* Cockerell, 1900[1,2,5]	par.	C	NA	*Megachile*
Coelioxys (*Boreocoelioxys*) *rufitarsis* Smith, 1854[1,2,5,8]	par.	G	NA	*Megachile*
Coelioxys (*Coelioxys*) *sodalis* Cresson, 1878[1,2,5]	par.	G	NA	*Megachile*
***Coelioxys* (*Cyrtocoelioxys*) *modestus* Smith, 1854**[2,8]	par.	C	NA	*Megachile campanulae*
Coelioxys (*Paracoelioxys*) *funerarius* Smith, 1854[1,2,5]	par.	G	NA	*Megachile*
Coelioxys (*Synocoelioxys*) *alternatus* Say, 1837[1,2,5]	par.	C	NA	*Megachile pugnata*
****Coelioxys* (*Xerocoelioxys*) *nodis* Baker, 1975**[2,6]	par.	C	NA	*Megachile*

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Megachile (*Chelostomoides*) *campanulae* (Robertson, 1903) (*exilis* group)[2,3]	sol.	C	poly.	Preference for *Campanula*
Megachile (*Eutricharaea*) *rotundata* (Fabricius, 1787)[E, 1,2]	sol.	C	poly.	
Megachile (*Litomegachile*) *brevis* Say, 1837[1,2]	sol.	C	poly.	
Megachile (*Litomegachile*) *mendica* Cresson, 1878[1,2]	sol.	C	poly.	
Megachile (*Litomegachile*) *texana* Cresson, 1878[1,2,5]	sol.	G	poly.	
Megachile (*Megachile*) *centuncularis* (Linnaeus, 1758)[1,2]	sol.	C	poly.	
Megachile (*Megachile*) *inermis* Provancher, 1888[1,2,5,8,9]	sol.	C	poly.	
Megachile (*Megachile*) *lapponica* Thomson, 1872[1,2]	sol.	C	poly.	
Megachile (*Megachile*) *montivaga* Cresson, 1878[1,2,5]	sol.	S	poly.	
Megachile (*Megachile*) *relativa* Cresson, 1878[1,2.5,9]	sol.	C	poly.	
***Megachile (Megachiloides) dakotensis* Mitchell, 1926**[2,6]	sol.	G	poly.	
***Megachile (Megachiloides) wheeleri* Mitchell, 1927**[RSKM]	sol.	G	poly.	
Megachile (*Phaenosarus*) *fortis* Cresson, 1872[3]	sol.	G	poly.	
Megachile (*Sayapis*) *pugnata pugnata* Say, 1837[1,2,8]	sol.	C	oligo.	Compositae
Megachile (*Xanthosarus*) *circumcincta* (Kirby, 1802)[1,2]	sol.	G	poly.	
Megachile (*Xanthosarus*) *frigida frigida* Smith, 1853[1,2,5,8,9]	sol.	C	poly.	
Megachile (*Xanthosarus*) *gemula gemula* Cresson. 1878[1,2,9]	sol.	C	poly.	
Megachile (*Xanthosarus*) *latimanus* Say, 1823[1,2,5,8,9]	sol.	G	poly.	
Megachile (*Xanthosarus*) *melanophaea melanophaea* Smith, 1853[1,2,5,6,8]	sol.	G	poly.	
Megachile (*Xanthosarus*) *perihirta* Cockerell, 1898[1,2,5,6]	sol.	G	poly.	
Osmiini				
***Ashmeadiella (Ashmeadiella) bucconis bucconis* (Say, 1837)**[2,6,8]	sol.	C	oligo.	Compositae
Heriades (*Neotrypetes*) *carinata* Cresson, 1864[1,2,5,6]	sol.	S	poly.	
Heriades (*Neotrypetes*) *variolosa variolosa* (Cresson, 1872)[1,2]	sol.	S	oligo.	Compositae
Hoplitis (*Alcidamea*) *albifrons albifrons* (Kirby, 1837)[1,2,5,8]	sol.	S	poly.	
Hoplitis (*Alcidamea*) *pilosifrons* (Cresson, 1864)[2,3,5,6]	sol.	S	poly.	
Hoplitis (*Alcidamea*) *producta producta* (Cresson, 1864)[1,2,5]	sol.	S	poly.	
Hoplitis (*Alcidamea*) *spoliata* (Provancher, 1888)[1,2]	sol.	S	poly.	
***Hoplitis (Alcidamea) truncata* (Cresson, 1878)**[2]	sol.	S	poly.	

(*Continued*)

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Table 1. (*Continued*)

Species	Nests	Substrate	Lecty	Floral or bee host
Hoplitis (*Formicapis*) *robusta* (Nylander, 1848)[1]	sol.	S	oligo.	*Potentilla*
***Osmia* (*Cephalosmia*) *subaustralis* Cockerell, 1900**[2]	sol.	S	oligo.	Compositae
***Osmia* (*Melanosmia*) *aquilonaria* Rightmyer *et al.*, 2010**[2]	sol.	unk.	poly.	
Osmia (*Melanosmia*) *atriventris* Cresson, 1864[1,2]	sol.	C	poly.	
Osmia (*Melanosmia*) *bucephala* Cresson, 1864[2,3,8]	sol.	C	poly.	
Osmia (*Melanosmia*) *cyaneonitens* Cockerell, 1906[2,3]	sol.	unk.	unk.	
Osmia (*Melanosmia*) *distincta* Cresson, 1864[1,2,6]	sol.	C	oligo.	*Penstemon*
***Osmia* (*Melanosmia*) cf. *grindeliae* Cockerell, 1910**	sol.	unk.	unk.	
***Osmia* (*Melanosmia*) *illinoensis* Robertson, 1897**[2]	sol.	C	unk.	
Osmia (*Melanosmia*) *inermis* (Zetterstedt, 1838)[1,2]	sol.	E	oligo.	*Vaccinium*
***Osmia* (*Melanosmia*) *inspergens* Lovell and Cockerell, 1907**[2]	sol.	E	poly.	
Osmia (*Melanosmia*) *integra* Cresson, 1878[1,2,5,6]	sol.	E	poly.	
Osmia (*Melanosmia*) *laticeps* Thomson, 1872[1,2]	sol.	unk.	oligo.	*Vaccinium*
Osmia (*Melanosmia*) *nearctica* Rightmyer *et al.*, 2010[1,2]	sol.	unk.	poly.	
Osmia (*Melanosmia*) *nigrifrons* Cresson, 1878[3,5]	sol.	unk.	unk.	
Osmia (*Melanosmia*) *nigriventris* (Zetterstedt, 1838)[1,2]	sol.	C	unk.	
Osmia (*Melanosmia*) *paradisica* Sandhouse, 1924[3]	sol.	unk.	unk.	
***Osmia* (*Melanosmia*) *proxima* Cresson, 1864**[2,5]	sol.	C	unk.	
Osmia (*Melanosmia*) *simillima* Smith, 1853[1,2,5]	sol.	C	poly.	
***Osmia* (*Melanosmia*) *subarctica* Cockerell, 1912**[2]	sol.	unk.	poly.	
Osmia (*Melanosmia*) *tarsata* Provancher, 1888[RSKM]	sol.	G	poly.	
Osmia (*Melanosmia*) *tersula* Cockerell, 1912[2,3]	sol.	C	poly.	
***Osmia* (*Melanosmia*) *trevoris* Cockerell, 1897**[2]	sol.	unk.	poly.	
***Osmia* (*Melanosmia*) *virga* Sandhouse, 1939**[2]	sol.	unk.	oligo.	*Vaccinium*
Osmia (*Osmia*) *lignaria lignaria* Say, 1837[1,2]	sol.	C	poly.	
Osmia (*Osmia*) *lignaria* Say, 1837 *propinqua* Cresson, 1864[1]	sol.	C	poly.	
Melittidae				
Melittinae				
Macropidini				
Macropis (*Macropis*) *nuda* (Provancher, 1882)[1,2,5,8,9]	sol.	G	oligo.	*Lysimachia*

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Results

We documented 392 species for Manitoba (Table 1), based on examination of more than 67 000 specimens. We found 154 new records for the province since 2015. *Brachymelecta, Eucera*, *Neolarra*, *Triepeolus*, *Ashmeadiella,* and *Dianthidium* represent new generic records for Manitoba during this time. Thirteen species are newly recorded for Canada: *Calliopsis* (*Nomadopsis*) *australior* Cockerell, 1897; *Perdita* (*Perdita*) *tridentata* Stevens, 1919; *Brachymelecta interrupta* (Cresson, 1872); *Diadasia* (*Dasiapis*) *ochracea* (Cockerell, 1903); *Melissodes bidentis* Cockerell, 1914; *Nomada crawfordi crawfordi* Cockerell, 1905; *Nomada fuscicincta* Swenk, 1915; *Nomada sphaerogaster* Cockerell, 1903; *Nomada xantholepis* Cockerell, 1911; *Triepeolus* cf. *grindeliae* Cockerell; *Coelioxys* (*Xerocoelioxys*) *nodis* Baker, 1972; *Dianthidium* (*Dianthidium*) *parvum* (Cresson, 1878); and *Megachile* (*Megachiloides*) *dakotensis* Mitchell, 1926. We propose that *Nomada alpha paralpha* Cockerell, 1921 and *N. alpha dialpha* Cockerell, 1921 are junior synonyms of *N. alpha* Cockerell, 1905, based on the type localities all being within a small geographical area (Supplementary material S1). *Nomada arenicola* Swenk, 1912 is considered a junior synonym of *N. fervida* Smith, 1854, due to a lack of morphological or genetic separation (Supplementary material S1). *Protandrena albertensis* (Cockerell, 1937) and *Neolarra mallochi* Michener, 1939 are recognised as valid species (Supplementary material S1). Supporting information for new and interesting records is provided in Supplementary material S1.

ANDRENIDAE

We document 74 andrenid bees in Manitoba, based on more than 4000 specimens, including 54 species of *Andrena,* three of *Calliopsis*, nine of *Perdita*, and eight of *Protandrena* for the province. *Perdita swenki* Crawford was by far the most common species, with over 1400 records, which were mostly collected in pan traps. Four species – *Andrena peckhami* Cockerell, *Andrena robervalensis* Mitchell, *Perdita octomaculata* (Say), and *Protandrena rudbeckiae* (Robertson) – are provisional records included solely based on unconfirmed literature accounts. Approximately half of the *Andrena* species (25) are oligolectic, and most of the panurgines are oligoleges.

APIDAE

We document 113 apid species, based on more than 23 000 records, including four species of *Anthophora, Apis mellifera,* 29 of *Bombus*, two of *Brachymelecta*, three of *Ceratina*, three of *Diadasia*, *Epeoloides pilosulus* (Cresson), seven of *Epeolus,* three of *Eucera*, three of *Holcopasites*, 18 of *Melissodes*, two of *Neolarra*, 29 of *Nomada*, and eight of *Triepeolus* for the province. Four apid genera were newly recorded for the province during this work: *Eucera, Triepeolus* (see also Wrigley *et al.* 2021), *Brachymelecta* (see also Onuferko *et al.* 2021), and *Neolarra*. Many new records come from the cleptoparasitic subfamily Nomadinae, including *Holcopasites calliopsidis* (Linsley), *H. heliopsis* (Robertson), *Neolarra vigilans* Cockerell, and *N. mallochi*, as well as 19 species of *Nomada* and eight of *Triepeolus.* The number of *Nomada* species remains uncertain until the genus can be revised. Eucerinae is also well represented by new records, including *Eucera* and six species of *Melissodes*.

COLLETIDAE

We document 33 colletid species, based on more than 2500 specimens, including 18 species of *Colletes* and 15 of *Hylaeus* for the province. Three-quarters of the *Colletes* are oligolectic (14 of 18). *Colletes albescens* Cresson is excluded from our verified list (see section on excluded bees in Supplementary material S1). *Colletes petalostemonis* was not re-examined and is based on a literature record (Sheffield *et al.* 2014). New records of *Hylaeus* include species that are typically quite rare and not commonly recorded in Canada.

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HALICTIDAE

We document 95 halictid species based on approximately 30 000 records, including four species of *Agapostemon, Augochlorella aurata* (Smith), *Dieunomia heteropoda* (Say), three species of *Dufourea,* five of *Halictus*, 62 of *Lasioglossum*, and 19 of *Sphecodes* for the province. Many new records are provided for *Lasioglossum* and *Sphecodes.* The latter is entirely composed of brood parasites. Two brood parasitic *Lasioglossum* are recorded, the first documented for the province. Several additional *Lasioglossum* are reported as new. *Sphecodes* needs revision; therefore, many individuals are identified tentatively. *Lasioglossum* have been revised for the region, but the *viridatum* group remains a challenge. Among the halictids, the only oligoleges are *Dieunomia heteropoda*, *L. aberrans* (Crawford), *L. lusorium* (Cresson), *L. nelumbonis* (Robertson), and the three *Dufourea*.

MEGACHILIDAE

We document 76 megachild species based on more than 6000 records, including three species of *Anthidium*, *Ashmeadiella bucconis* (Say), nine species of *Coelioxys*, three of *Dianthidium*, two of *Heriades*, six of *Hoplitis*, 20 of *Megachile*, 24 of *Osmia*, and eight of *Stelis* for the province. The genus *Ashmeadiella* is newly recorded for the province. *Dianthidium parvum* is a new Canadian record. These new records include one exotic species, *Anthidium manicatum* Linnaeus. Both the nominal subspecies of *Osmia lignaria* and the subspecies *O. lignaria propinqua* are recorded for the province. The latter has been introduced by commercial retailers of *Osmia*.

MELITTIDAE

We record one species, *Macropis nuda* (Provancher), based on 85 specimens (Gibbs *et al.* 2021). Although *M. ciliata* Patton has appeared on some lists for the province, this was apparently based on a misidentified specimen of *M. nuda* at the Illinois Natural History Survey. Examination of the Illinois Natural History Survey specimen revealed it to have the dark basitibial hairs and sculptured metapostnotum typical of *M. nuda*. The original determination label also reads *M. nuda*.

Discussion

Our study documents a 64.7% increase in the known species richness since 2015 and a 15.6% increase in the known generic richness of bees in Manitoba. The notable increase is the result of recent intensive sampling of a historically undersampled region for bees and examination of large numbers of specimens (including previously unidentified material) from museum collections. In comparison, Sheffield and Heron's (2019) recent checklist of the bees of British Columbia, which has been better sampled historically for bees, documented only an 8.3% increase in the known species richness for that province, bringing the total number to 483 species. That Manitoba should contain upwards of 40% of the species of bees known to occur in Canada can be explained by its geographic position at the longitudinal centre of Canada and as the transition from eastern forests into western prairie. Manitoba thus marks the easternmost range for multiple western species and the westernmost range for multiple eastern species.

The disparate habitats and floral communities present in Manitoba, from boreal forests to prairies, provide for a more diverse bee fauna than was previously realised. Habitat conditions may affect proportions of different plant syndromes and the prevalence of associated pollinators (Robson *et al.* 2019). Earlier checklists documented fewer than 250 species (Sheffield *et al.* 2014; Canadian Endangered Species Conservation Council 2015); however, we record 392 bee species in the province. We would like to draw attention to three areas that are of particular interest for future studies. First, we found records of many eastern species that had previously gone undetected. It is likely that additional studies in the southeastern corner of Manitoba, which has not been thoroughly sampled, will reveal more records of

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eastern bees. Recent records of the endangered *Epeoloides pilosulus* have been found in this region (Gibbs *et al.* 2021). Second, most of the province is comprised of northern ecoregions, where the bee fauna differs substantially from that in the south (Sheffield *et al.* 2014; Williams *et al.* 2014). Some records are available from Churchill; however, an enormous area in Manitoba is undersampled. It is critical that we obtain a better understanding of this northern fauna because climate change is likely to have a disproportionate effect on these cold-adapted bees (Kerr *et al.* 2015). Finally, the area around Spruce Woods Provincial Park and Canadian Forces Base Shilo provides diverse habitat for bees and other species (Wrigley 1974; Acorn 2011). Even though this has been a popular collecting site for many years, new records and even new species (Onuferko 2018) have been found here in recent years. In some cases, these records are widely separated from the species' nearest known records; for example, the nearest record of *Diadasia ochracea* is in Colorado (Adlakha 1969; Snelling 1994). More studies of this region and the areas to the southwest are likely to reveal more interesting taxa. Conservation of this area is critical to the province's biodiversity. The famous "Spirit Sands" in Spruce Woods Provincial Park are contracting as vegetation encroaches, leading to less area of open sand (Hugenholtz *et al.* 2010). It is unclear how this may affect dune-adapted species, such as *Megachile dakotensis* and *Nomada fervida*, but it would be prudent to study this aspect to allow for best management practices.

An important caveat to our study is the limited taxonomic knowledge of some of the most diverse bee lineages. In particular, *Nomada*, *Osmia*, *Sphecodes*, and *Stelis* have never been revised for species occurring in this area (Michener 2007). For these taxa, Mitchell's (1960, 1962) works include some of the best keys to species, despite numerous taxonomic updates (Schwarz and Gusenleitner 2004; Droege *et al.* 2010; Rightmyer *et al.* 2010, 2011; Gibbs *et al.* 2017). Although Manitoba has many elements of eastern fauna, there are also substantial numbers of species from the Great Plains and further west that are not treated in modern taxonomic studies. Other taxa, such as *Lasioglossum* and *Melissodes*, remain a challenge even with available taxonomic revisions (LaBerge 1961; Gibbs 2010). We expect that, in addition to new records being found with additional sampling, some of our determinations will also require updates as the taxonomic understanding of bees in this region improves. We hope that highlighting the diversity of the Manitoba bee fauna and the uncertainty in some taxa will encourage additional taxonomic studies in these groups.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.4039/tce.2022.45.

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